Having thus described the preferred embodiments, the invention is now claimed to be:

1. A method for calibrating a coincidence imaging system which includes a plurality of radiation detectors, the method comprising:

measuring a plurality of coincidence radiation events associated with a point radiation source;

assigning initial values for a set of fitting parameters;

applying a minimization algorithm including:

calculating lines of response (LOR) based upon the fitting parameters and the measured radiation events,

generating a figure of merit characterizing the apparent size of the point radiation source based upon the LOR's, and

optimizing the fitting parameters to produce a minimized figure of merit; and

extracting from the optimized fitting parameters a correction factor relating to a positional coordinate of a detector.

2. A method for imaging using a plurality of radiation detectors, the method comprising:

measuring a plurality of coincidence radiation events associated with a point radiation source;

assigning initial values for at least one fitting parameter;

calculating lines of response (LOR) based upon the at least one fitting parameter and the measured radiation events;

generating a figure of merit characterizing the apparent size of the point radiation source based upon the LOR's;

optimizing the at least one fitting parameter using a minimization algorithm which includes iteratively repeating the calculating and generating steps to produce a minimized figure of merit;

extracting from the at least one optimized fitting parameter at least one correction factor;

acquiring a set of radiation data from an associated subject;

correcting the radiation data for camera misalignment by correcting the spatial coordinates of the detected radiation events using the at least one correction factor; and

reconstructing an image representation from the corrected radiation data.

3. The imaging method as described in claim **2**, wherein the at least one fitting parameter includes:

a parameter related to the radial positional coordinate of a detector.

4. The imaging method as described in claim **2**, wherein the at least one fitting parameter includes:

a parameter related to the tangential positional coordinate of a detector.

5. The imaging method as described in claim **2**, wherein the at least one fitting parameter includes:

a parameter related to the orientational positional coordinate of a detector.

6. The imaging method as described in claim **2**, wherein:

the step of generating a figure of merit includes summing a distance of closest approach of each LOR to a spatial point; and

the at least one fitting parameter includes the positional coordinates of the spatial point.

7. The imaging method as described in claim **2**, wherein:

the step of generating a figure of merit includes summing the square of a distance of closest approach of each LOR to a spatial point; and

the at least one fitting parameter includes the positional coordinates of the spatial point.

8. The imaging method as described in claim **7**, wherein the step of generating a figure of merit further includes:

discarding LOR's whose distance of closest approach is greater than a preselected distance.

9. The imaging method as described in claim **2**, wherein the step of generating a figure of merit further includes:

obtaining a crossing point of each pair of LOR's; and

calculating a standard deviation of the crossing points.

10. The imaging method as described in claim **2**, wherein the step of generating a figure of merit further includes:

obtaining a distance of closest approach for each pair of LOR's; and

calculating a standard deviation of the obtained distances.

11. The imaging method as described in claim **2**, wherein the number of detectors is N and the fitting parameters include:

Δr_i, i=1 to N, where Δr_i is a correction for the radial coordinate of the ith detector;

Δt_j, j=1 to N, where Δt_j is a correction for the tangential coordinate of the jth detector; and

$\Delta\theta_k$, k=2 to N, where $\Delta\theta_k$ is a correction for the orientational coordinate of the kth detector.

12. The imaging method as described in claim **11**, wherein the fitting parameters further include:

positional coordinates of the point radiation source.

13. A method of PET imaging comprising:

coincidence detecting radiation events from a calibration source with at least two detector heads;

calculating correction factors that correct for mechanical misalignment of the detector heads from the coincidence detected calibration source radiation;

during a diagnostic imaging procedure performed on a subject, generating image data in response to radiation collected with the detector heads;

correcting the image data with the correction factors; and

reconstructing the corrected image data into an image representation.

14. A coincidence imaging system comprising:

a gantry;

a plurality of flat panel detectors disposed about the gantry;

a data memory which stores measured data about radiation events detected by the detectors;

a calibration memory which stores a plurality of calibration parameters for correcting data measured during a patient scan; and

a processor in communication with the calibration memory and with the data memory which calculates the calibration parameters by a minimization

algorithm that includes optimizing fitting parameters with respect to acquired radiation data associated with a point radiation source.

15. The imaging system of claim **14** wherein the minimization algorithm further includes:

calculating lines of response (LOR) based upon the fitting parameters and the measured data;

generating a figure of merit characterizing the apparent size of the point radiation source based upon the LOR's; and

optimizing the fitting parameters to produce a minimized figure of merit.

16. The imaging system of claim **15** wherein the calibration parameters include:

parameters relating to positional coordinates of the plurality of detectors.

17. The imaging system of claim **16**, wherein:

the gantry is a rotatable gantry which acquires measured data over a range of gantry angular positions.

18. The imaging system of claim **14**, wherein:

the figure of merit is generated by summing the square of a distance of closest approach of each LOR to a spatial point; and

the fitting parameters include the positional coordinates of the spatial point.

19. The imaging system of claim **14**, wherein the generating of the figure of merit includes:

obtaining a crossing point of each pair of LOR's; and

calculating a variance of the crossing points.

20. The imaging system of claim **14**, wherein the minimization algorithm further includes:

discarding measured data about radiation events whose energy is outside a preselected energy range.